

08/649419
08/649419

FIG. 4

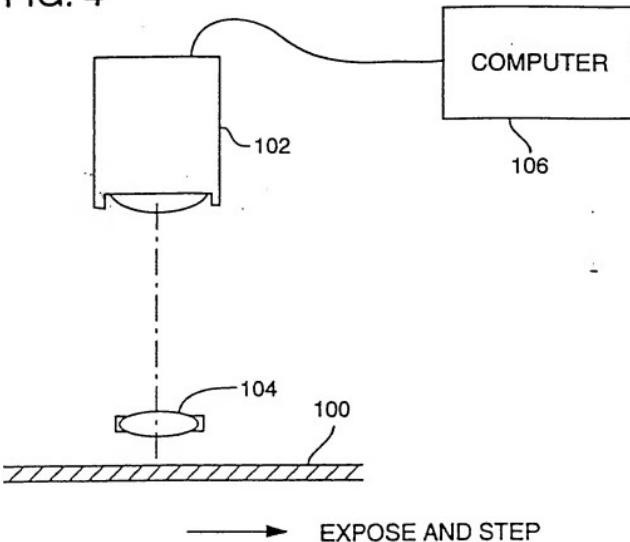


FIG. 1

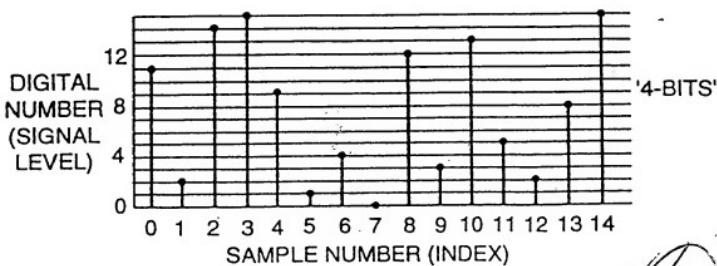


FIG. 2

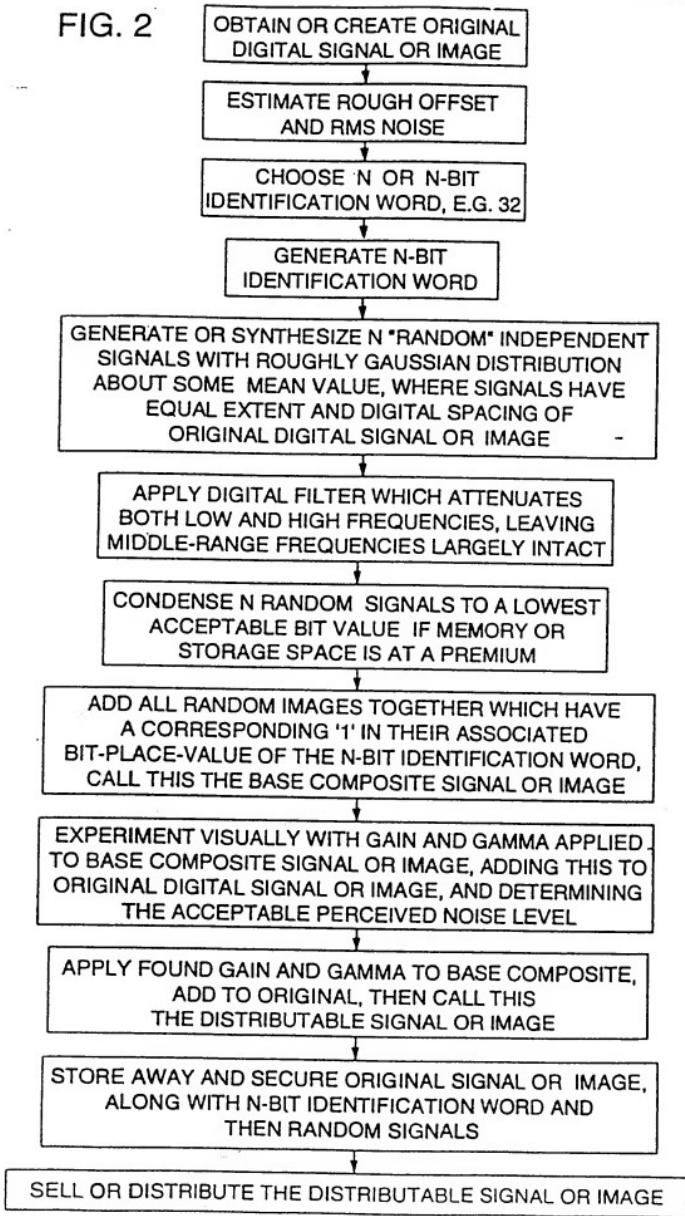


FIG. 3

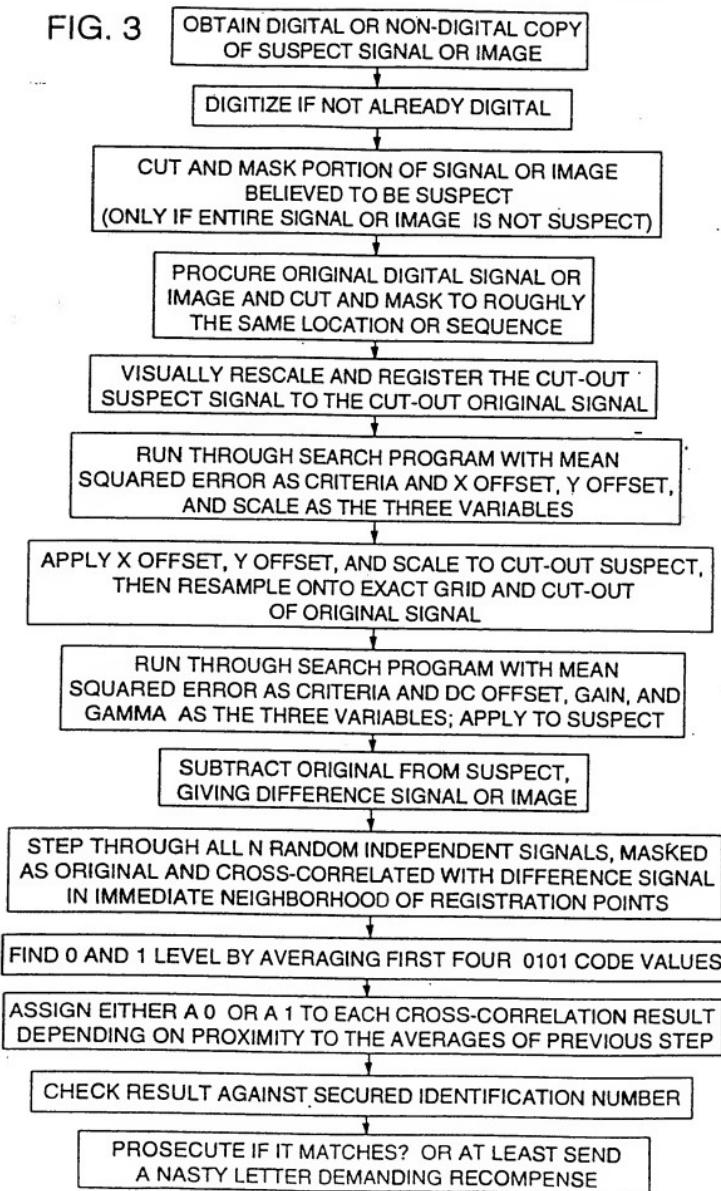


FIG. 5

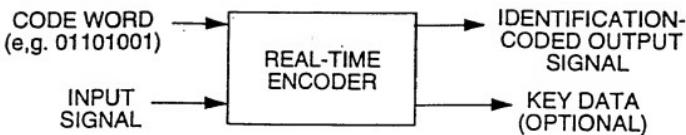
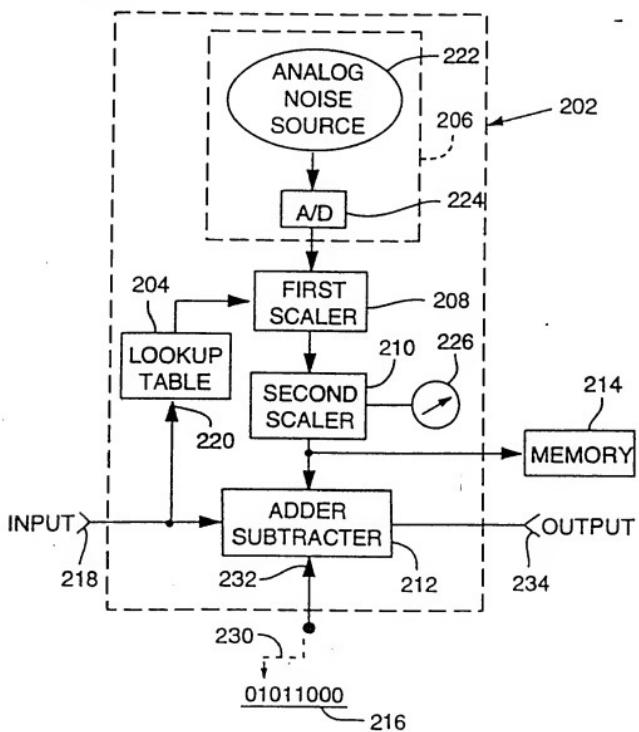


FIG. 6



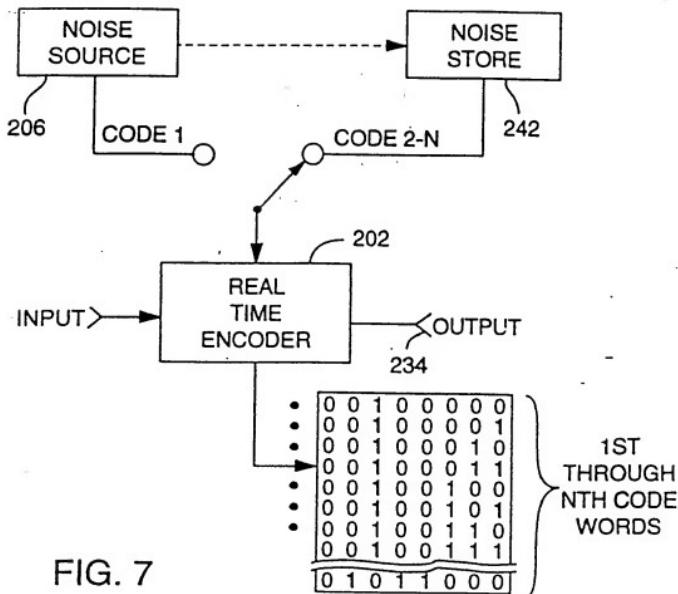


FIG. 7

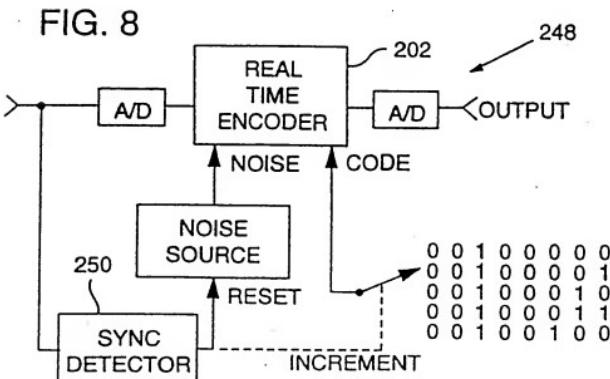
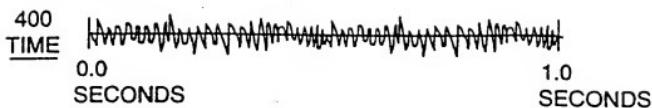
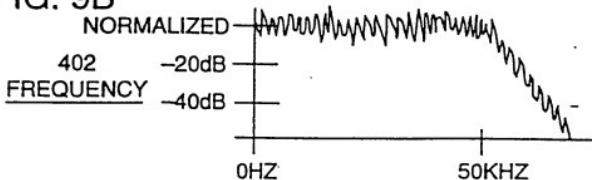


FIG. 8

FIG. 9A**FIG. 9B****FIG. 9C**

BORDER
CONTINUITY
404

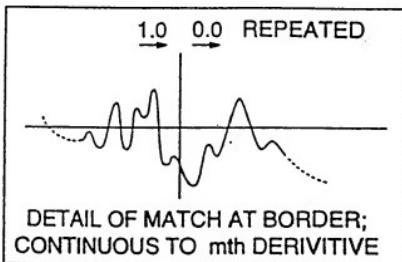
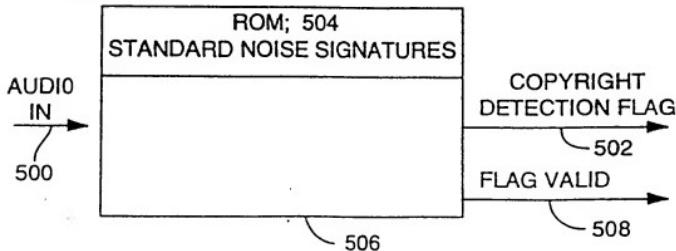
**FIG. 10**

FIG. 11

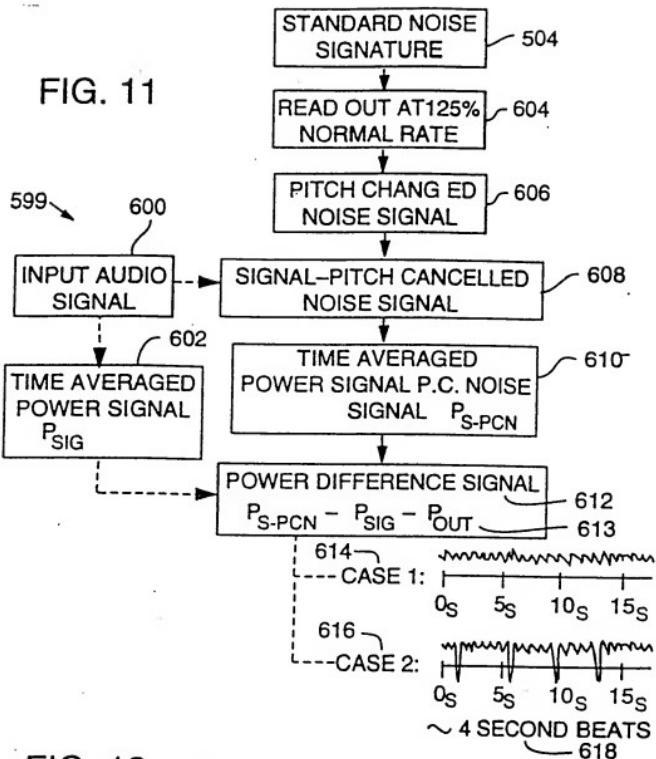


FIG. 12

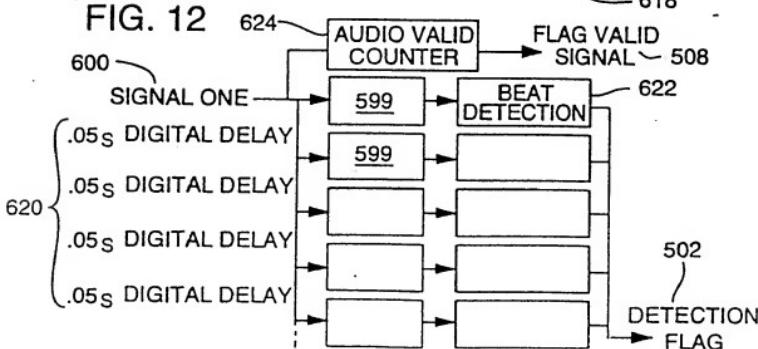
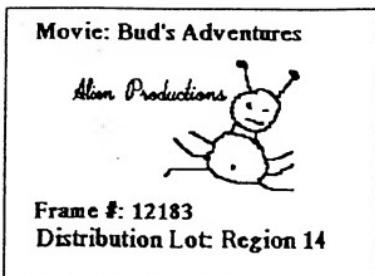
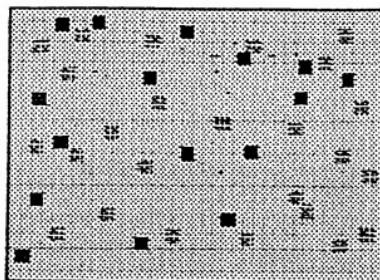


Figure 13



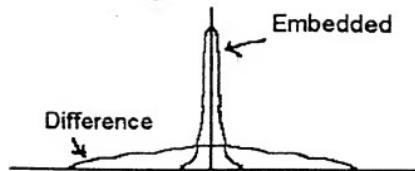
700

Encryption/Scrambling
Routine # 28 ,702

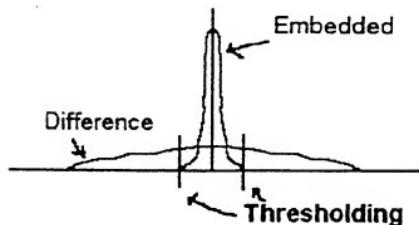


704 Pseudo-Random Master Snowy Image
(Scaled Down and Added to Frame 12183)

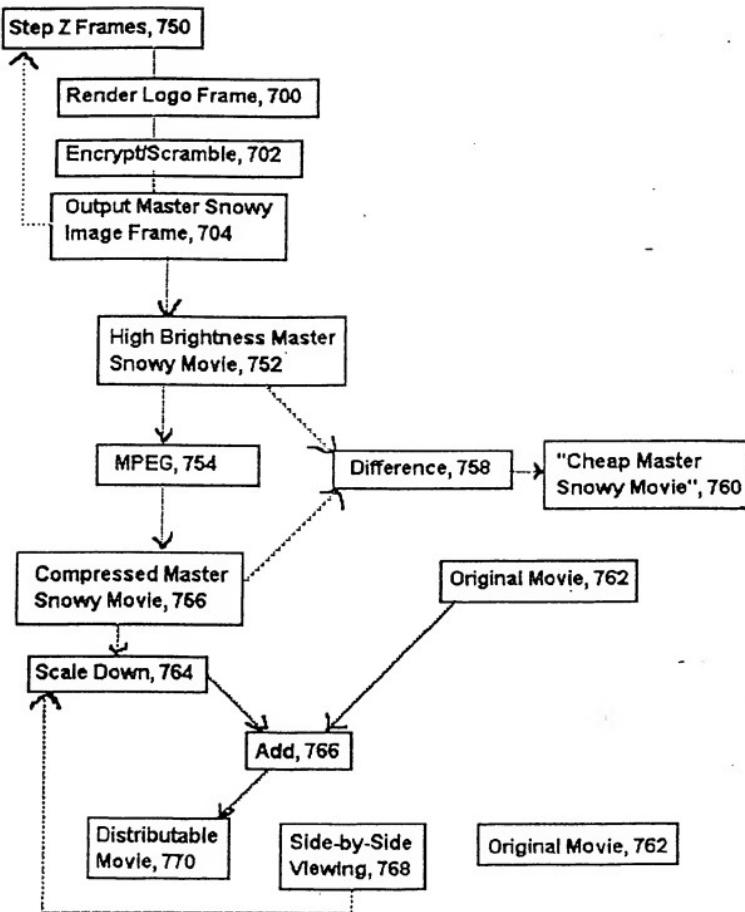
Figure 14



720, Mean-Removed Histograms of
Difference Signal and Known Embedded
Code Signal

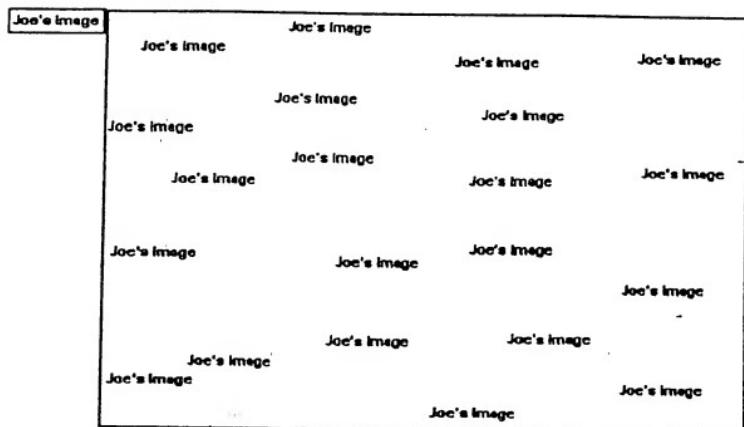
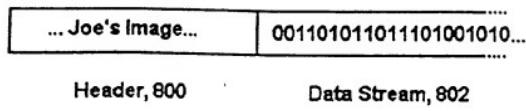


722, Mean-Removed Histograms of
First Derivatives (or scalar gradients
In the case of an image)

Figure 15

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Figure 16



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Figure 17

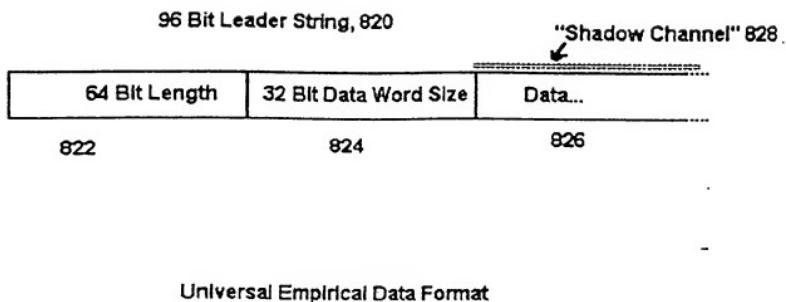
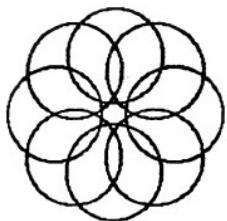
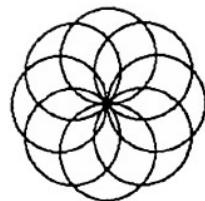


Figure 18



Supra-radial Knots, 850



Radial Knots, 852

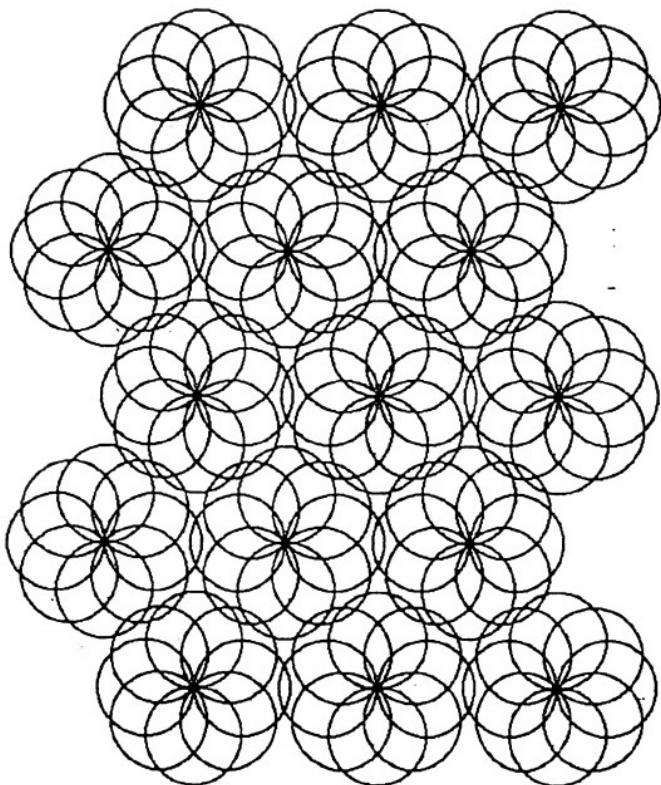


854, One basic concept of the knot is an overlapping of
one strand of finite width over another strand



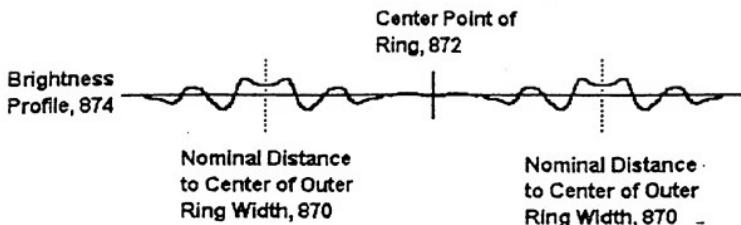
864, Another basic concept is the symmetric weaving of overlaps

Figure 19



866, Quest for Mosaiced Knot Patterns which "Cover" and
are Coextensive with Original Image;

All elemental knot patterns can convey the same
information, such as a signature, or each can convey a
new message in a steganographic sense

Figure 20

876, 2-D brightness of phase-only filtered ring is similar to
the above brightness pattern rotated about central point
of ring :

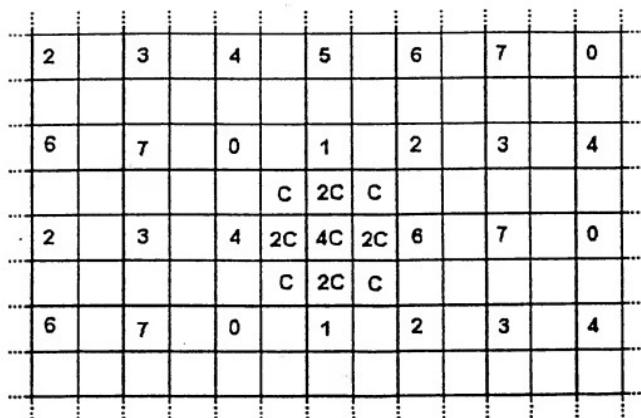


Figure 21A

C	2C	C
2C	4C	2C
C	2C	C

where $C = 1/16$

Elementary Bump, 900
 (Defined grouping of pixels with
 weight values)



Example of how elementary bumps, 900, would be assigned locations in an image, and those locations would be associated with a corresponding bit plane in the N-bit word, here taken as $N=8$ with indexes of 0-7. One location, associated with bit plane "5", has the overlay of the bump profile depicted.

FIG. 21B

Figure 22

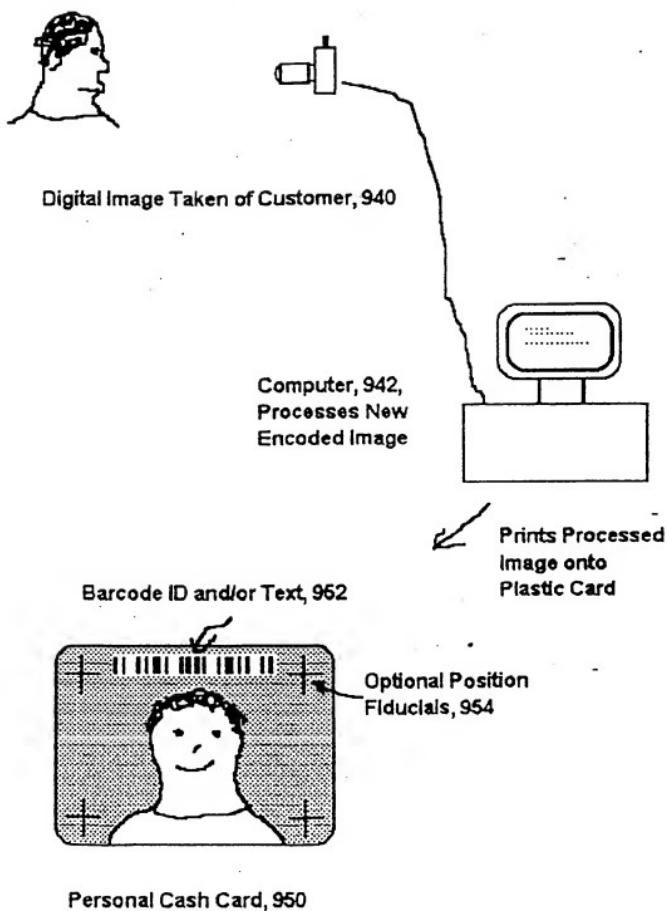
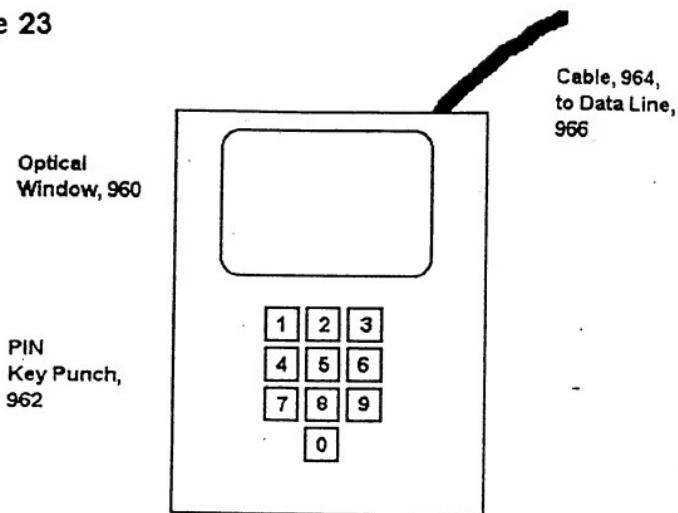


Figure 23



Low Cost Point-of-Sale Optical Reader, 958

Contains rudimentary optical scanner,
memory buffers, communications devices,
and microprocessor

Consumer merely places card into window and can, at their pre-arranged option, either type in a Personal Identification Number (PIN, for added security) or not. The transaction is approved or disapproved within seconds.

Figure 24



Original Digital Image with
Barcode and Fiducials
Added, 970



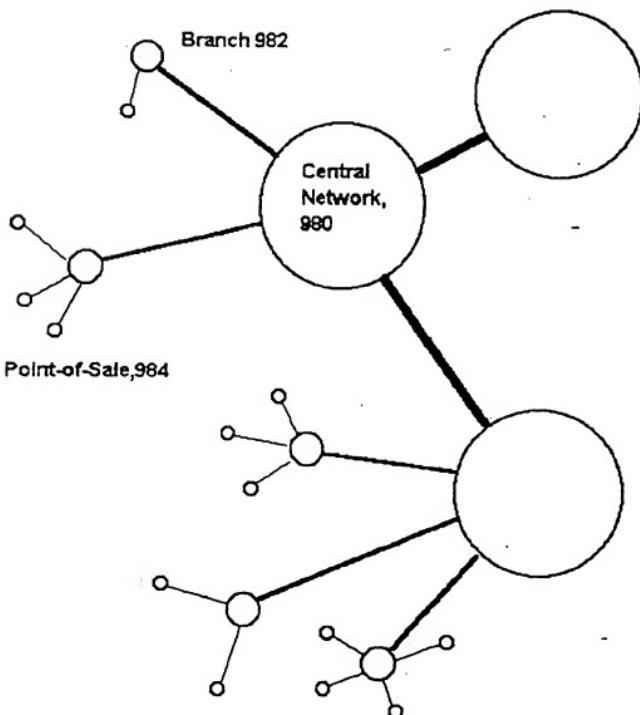
Computer generates Master
Snowy Image 972, which is
generally orthogonal to
Original Image at left



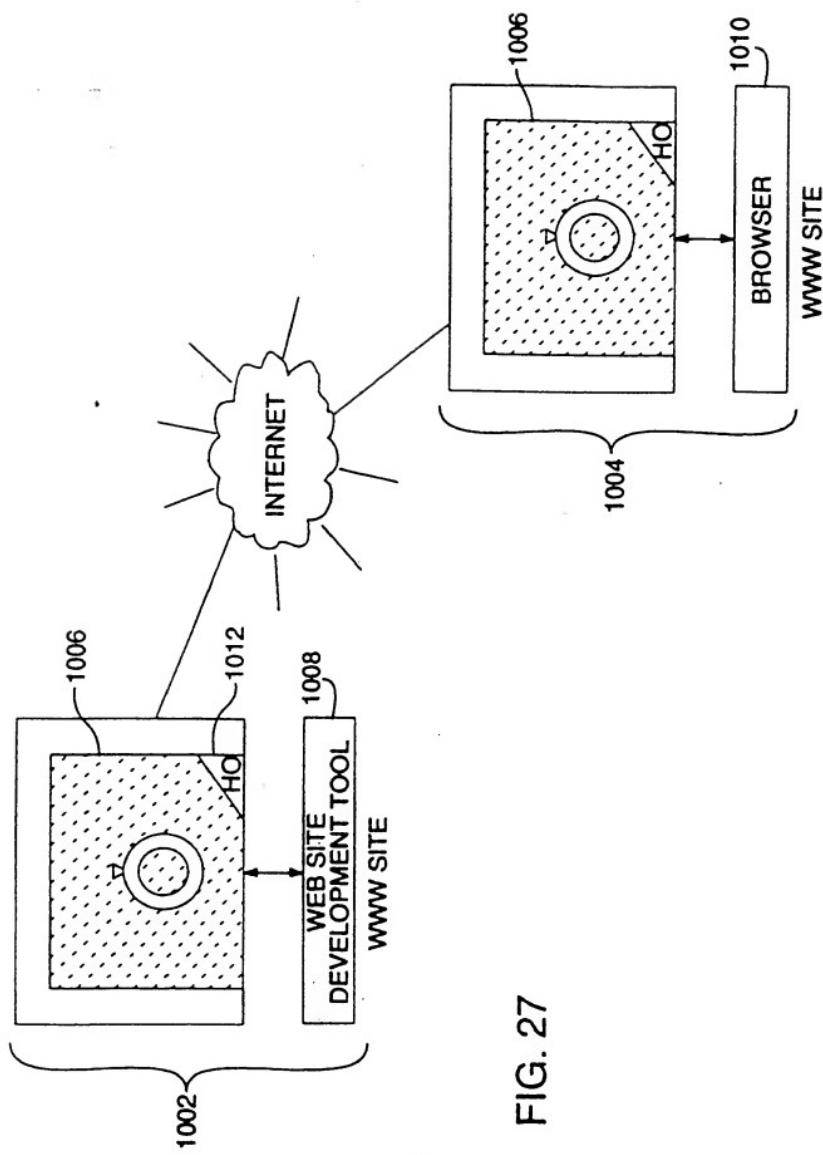
Combined to form Personal Cash Card, 950

Figure 25 Typical Transaction Steps

1. Reader scans images on card, stores in memory, extracts persons ID
2. Optional: User keys in PIN number
3. Reader calls central account data network, handshakes
4. Reader sends ID, (PIN), merchant information, and requested transaction amount to central network
5. Central Network verifies ID, PIN, Merchant info, and account balance
6. If OK, Central Network generates twenty four sets of sixteen distinct random numbers, where the random numbers are indexes to a set of 64K orthogonal spatial patterns
7. Central Network transmits first OK, and the sets of random numbers
8. Reader steps through the twenty four sets
 - 8A. Reader adds together set of orthogonal patterns
 - 8B. Reader performs dot product of resultant pattern and card scan, stores result
9. Reader transmits the twenty four dot product results to Central Network
10. Central Network checks results against master
11. Central Network sends final approval or denial
12. Central Network debits Merchant Account, credits Card account

Figure 26**The Negligible-Fraud Cash Card System**

A basic foundation of the cash card system is a 24 hour information network, where both the stations which create the physical cash cards, 950, and the point-of-sales, 984, are all hooked up to the same network continuously.



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Fig. 27A

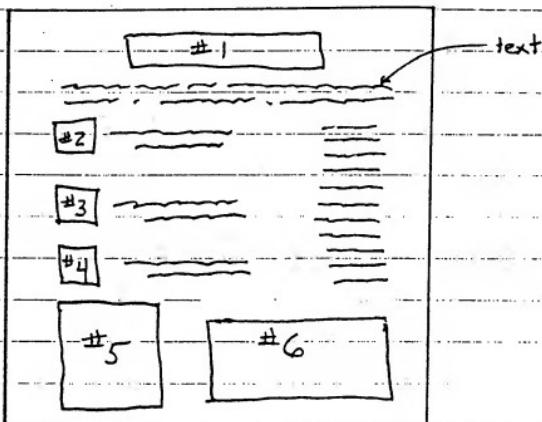
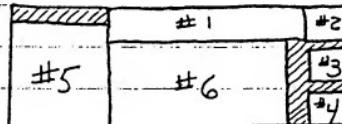


Fig. 27B



08/649419

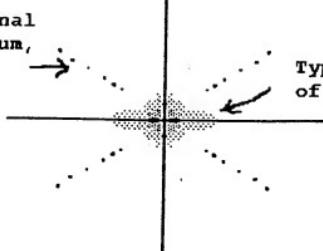
Fig. 28



Figure 29

UV Plane, 1000

Embedded Signal
Power Spectrum,
1002



A 2D coordinate system with a horizontal and vertical axis. A central cross-shaped pattern of dots is surrounded by a grid of diagonal lines forming a weave-like cross-hatching pattern. Arrows point from the text labels to this central pattern.

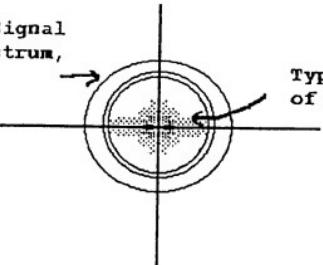
Typical Power Spectrum
of Arbitrary Image,
1004

Non-harmonic spatial frequencies along the
45 degree axes, giving rise to a weave-like
cross-hatching pattern in the spatial domain

Figure 30

UV Plane, 1000

Embedded Signal
Power Spectrum,
1006



A 2D coordinate system with a horizontal and vertical axis. Concentric circles of dots are centered at the origin, with the innermost circle being the most dense. Arrows point from the text labels to the center of these concentric patterns.

Typical Power Spectrum
of Arbitrary Image,
1004

Non-harmonic concentric circles in UV plane,
where phase hops quasi-randomly along each
circle, giving rise to pseudo random looking
patterns in the spatial domain

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Fig. 29A

One Quadrant
Spatial Transform Domain

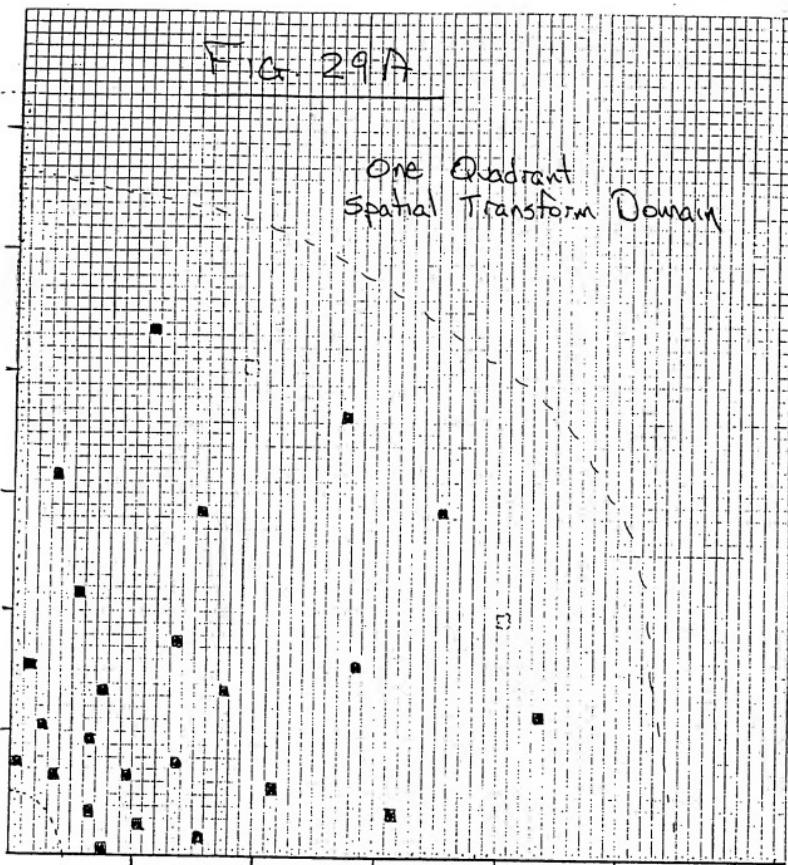
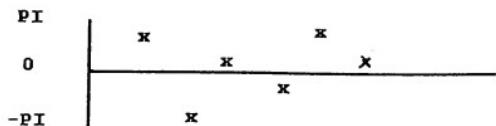
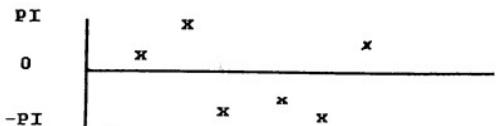


Figure 31A



Phase of spatial frequencies along forward 45 degree axes, 1008



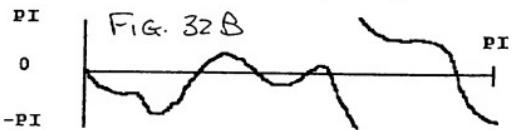
Phase of spatial frequencies along backward 45 degree axes, 1010

FIG. 31B

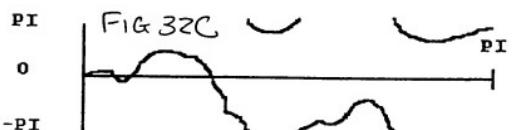
Figure 32A



Phase of spatial frequencies along first concentric ring, 1012



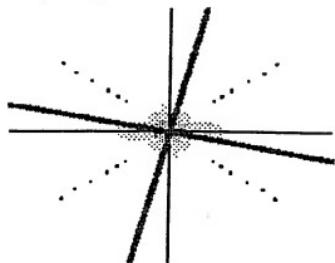
Phase of spatial frequencies along second concentric ring, 1014



Phase of spatial frequencies along third concentric ring, 1016

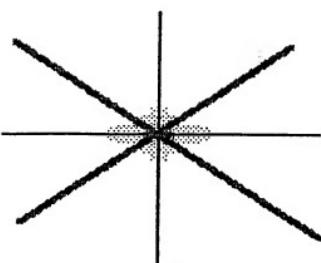
-PI

Figure 33A



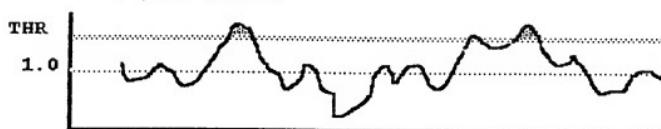
Angle A 1018

FIG. 33B



Angle B 1020

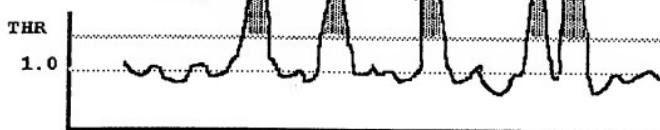
FIG. 33C



Power profile along Angle A, as normalized by its own moving average; only a minimal amount exceeds threshold, giving a small integrated value

1022

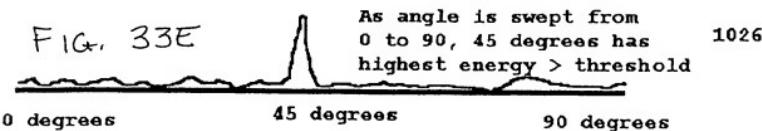
FIG. 33D



Power profile along Angle B, as normalized by its own moving average; this finds strong energy above the threshold

1024

FIG. 33E

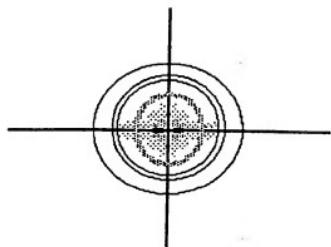


As angle is swept from 0 to 90, 45 degrees has highest energy > threshold

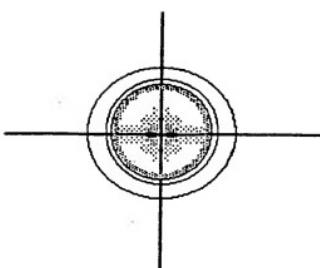
1026

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Figure 34A



Radius A, 1028



Radius B, 1030

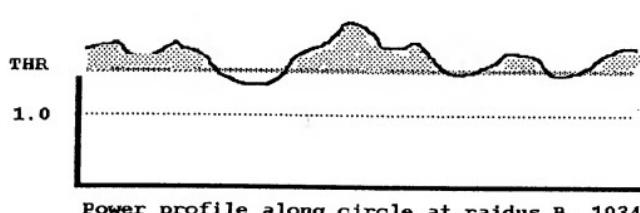
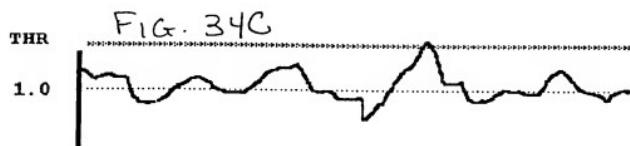
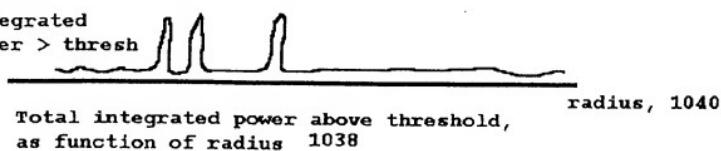


FIG 34D

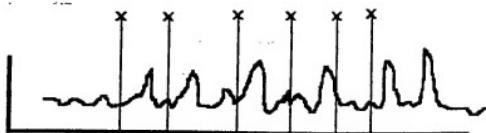
1036 FIG. 34E

Integrated
Power > thresh



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Figure 35A



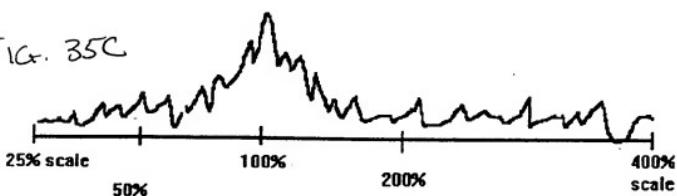
Scale = A; add all power values at the "known" frequencies, 1042

FIG. 35B



Scale = B; add all power values at the "known frequencies, 1044

FIG. 35C



"Scaled-kernel" based matched filter; peak is where the scale of
the subliminal grid was found, 1046

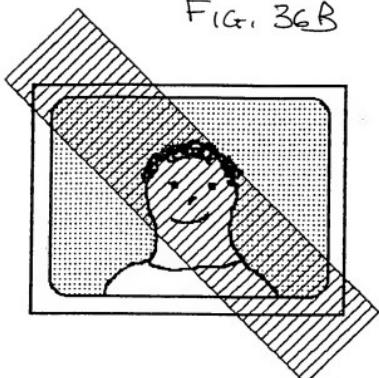
08/649419

Figure 36A



Arbitrary Original Image, 1050,
in which subliminal
graticules may have been placed

FIG. 36B



"Column scan", 1052
is applied along a
given angle through
the center of the
image

Column-
integrated
grey
values,
1054

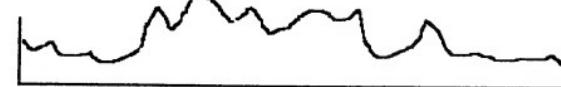
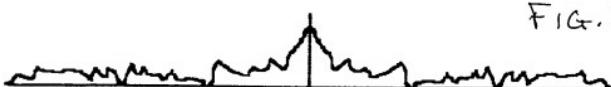


FIG. 36C



Magnitude of Fourier Transform of scan data,
1060

FIG. 36D

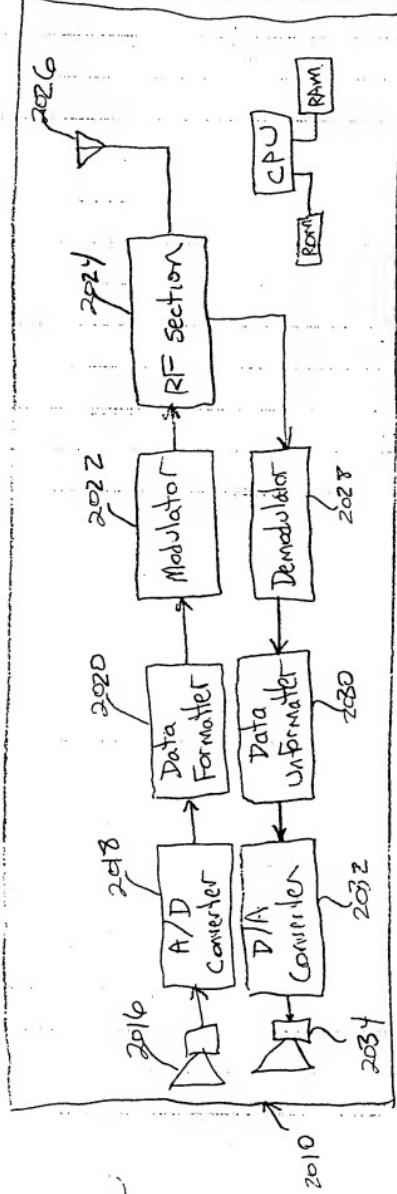
Figure 37

Process steps

1. Scan in photograph
2. 2D FFT
3. Generate 2D Power spectrum, filter with e.g.
3x3 blurring kernel
4. Step angles from 0 degrees through 90 (1/2 deg)
5. generate normalized vector, with power value
as numerator, and moving averaged power
value as denominator
6. integrate values above some threshold, giving
a single integrated value for this angle
7. end step on angles
8. Find top one or two or three "peaks" from the
angles in loop 4 , then for each peak...
9. Step scale from 25% to 400% ,step ~1.01
10. Add the normalized power values corresponding
to the 'N' scaled frequencies of standard
11. Keep track of highest value in loop
12. end loop 9 and 8, determine highest value
13. Rotation and scale now found
14. Perform traditional matched filter to
find exact spatial offset
15. perform any "fine tuning" to precisely
determine rotation, scale, offset

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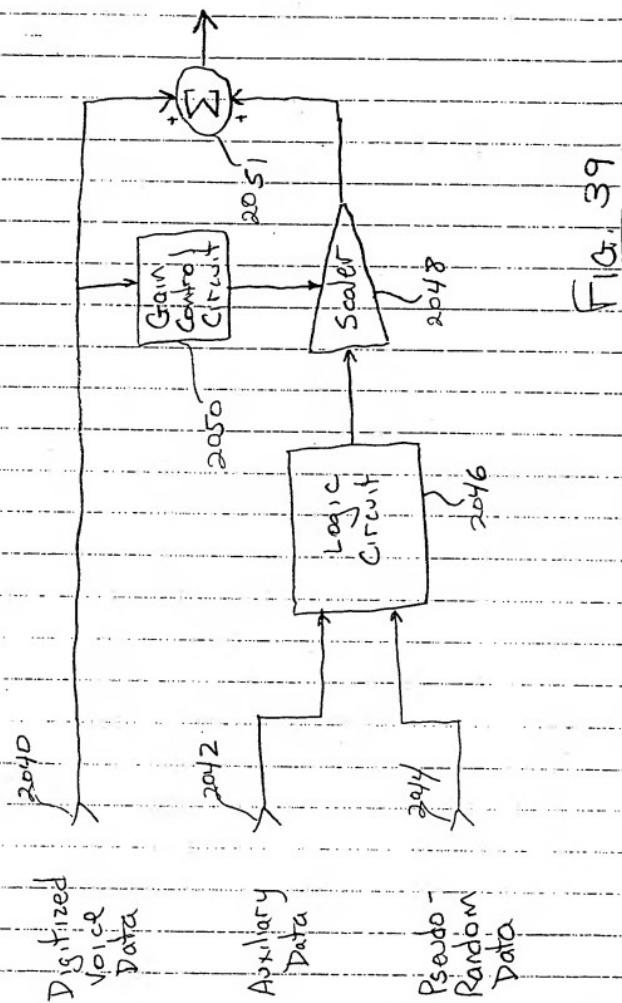
F. G. 38



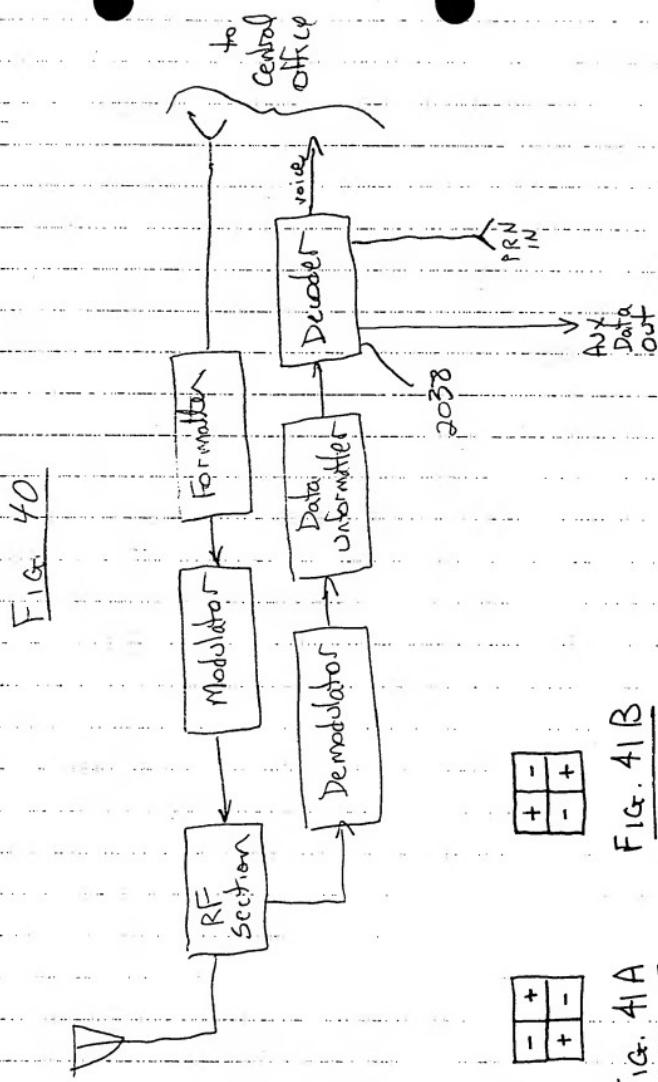
08/649419

3036

Encoded
Output
Signal



12



08/649419

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